May 1975 B75-10082

NASA TECH BRIEF

Ames Research Center

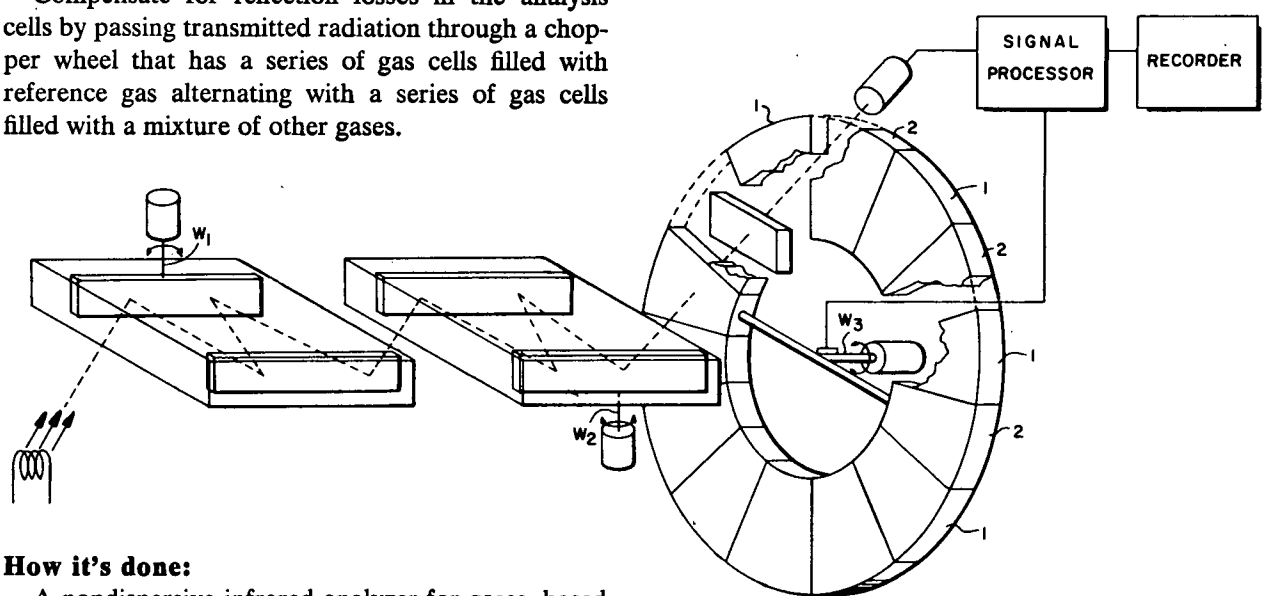
A Nondispersive Infrared Analyzer

The problem:

To design a nondispersive infrared analyzer that compensates for reflection losses when the path length of gas cells is modulated by nutating mirrors.

The solution:

Compensate for reflection losses in the analysis cells by passing transmitted radiation through a chopper wheel that has a series of gas cells filled with reference gas alternating with a series of gas cells filled with a mixture of other gases.



How it's done:

A nondispersive infrared analyzer for gases, based on absorption-modulation ratios of known and unknown samples, has been described previously (Reference 1). In essence, any of the parameters affecting the energy-absorbing characteristics of a reference gas and a gas sample are modulated in such a way that variations in intensity of transmitted energy provide information about the amount of reference-gas component in the sample. Absorption can be modulated sinusoidally by varying the gas density with an acoustic driver; alternatively, the path length in the reference and sample cells can be varied sinusoidally by mobile mirrors (Reference 2).

The diagram depicts a system which compensates for reflection losses in a path-length-modulated nondispersive infrared analyzer. The left chamber contains a reference gas at a known partial density; the right chamber contains a gas sample in which the reference gas is at an unknown concentration. Infrared radiation from a hot filament is passed through the chambers while the path length of the radiation in the chambers is modulated at frequencies ω_1 and ω_2 as provided by nutating mirrors.

After passing through both cells, the radiation is intercepted by a chopper wheel that consists of a series of gas cells filled in alternation with a sample of the reference gas (marked 1) and an admixture of other gases (marked 2). The chopper wheel intersects radiant energy at a frequency ω_3. When in the radiation path, the number 1 cells in the chopper wheel absorb all or at least a portion of the radiant energy

(continued overleaf)

in the spectral regions normally affected by the reference gas and, in turn, number 2 cells absorb energy in the spectral regions normally affected by the admixed gases. The radiation passing through the chopper wheel impinges on a detector and generates the output signal from which is derived information as to the concentration of the reference gas in the sample.

The apparatus described above retains all the advantages of the nondispersive infrared analysis systems described priorly and provides significantly more immunity to the type of errors that may be introduced by geometric changes in the analysis system. Moreover, the technique described above permits construction of instruments of lower weight, smaller volume, and smaller power consumption.

References:

1. Dimeff, J., *et al.:* NASA Tech Brief B72-10198, May 1972.
2. Dimeff, J.: NASA Tech Brief B74-10243, December 1974.

Note:

No additional documentation is available. Specific questions, however, may be directed to:

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Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

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